

EXHIBIT E



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December 23, 2013

Robert M. Cook, Esquire
Goldberg Segalla LLP
902 Carnegie Center, Suite 100
Princeton, NJ 08540-6530

Subject: Medina v. Daimler Trucks
Project No. 1108469.000

Dear Mr. Cook:

In accordance with your request, Exponent has performed a biomechanical analysis of the tractor-trailer crash of February 5, 2008, which involved Mr. Edvin Medina. The objective of this analysis was to evaluate Mr. Medina's occupant kinematics during the crash, and to determine the biomechanical mechanisms and assess the severity of the blunt force injuries detailed in his autopsy report.

Materials Received

The following materials were received and reviewed:

- Accident Information:
 - State of Vermont Uniform Crash Report, dated February 5, 2008
 - Vermont State Police Motor Vehicle Crash Supplemental Report of Investigation, undated
 - Vermont State Police Measurement Data Log, dated February 5, 2008
 - Brattleboro Police Department Fire Incident Report and Supplement to Incident Report, dated February 5 and 8, 2008, Bates DTNA 00188-00200
- Vehicle and Insurance Information:
 - Discovery materials produced by Daimler Trucks North America (DTNA), LLC
 - Delivery receipts, Bates DTNA 00001-00002
 - Invoices, Bates DTNA 00003-00017
 - Quality assurance file, Bates DTNA 00018-00043
 - Warranty, Bates DTNA 00044-00063
 - Customer assistance center information, Bates DTNA 00064-00065
 - Chassis specification documents, Bates DTNA 00084-00148
 - Sahi Trucking documents, Bates DTNA 00167-00187

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- Truck Specification Order, Bates DTNA 00066-00083
- Legal Documents – Defendant DTNA:
 - Defendant Daimler Trucks North America LLC's Answer to Plaintiffs' Complaint and Crossclaims, dated July 6, 2010
 - Daimler Trucks North America LLC's F.R.Cv.P.26 Initial Disclosures, dated November 29, 2011
 - Daimler Trucks North America LLC Supplemental F.R.Cv.P.26 Disclosures, dated December 14, 2011
 - Daimler Trucks North America LLC's Answers to Plaintiff's Interrogatories, undated
 - Daimler Trucks North America LLC's Answers to Plaintiff's Notice for Production of Documents, dated March 9, 2012
- Legal Documents – Scheduling Order in an Arbitration Case, dated November 2, 2011
- Legal Documents – Plaintiff:
 - Complaint and Jury Demand, dated February 4, 2010
- Photographs:
 - Digital photographs (23) of autopsy of Edvin Medina by Vermont Medical Examiner's Office
 - Digital photographs (255) of accident scene by Vermont State Police, dated February 5, 2008
- Deposition Testimony
 - Deposition transcript of Christopher Buckley, with exhibits, dated December 19, 2011
 - Deposition transcript of Richard C. Holden, Jr., dated December 19, 2011
 - Deposition transcript of Richmond Hopkins, III., dated December 20, 2011
 - Deposition transcript of Claude R. Marcoux, with exhibits, dated December 20, 2011
 - Deposition transcripts of Albert M. Stringer, with exhibits, dated December 21, 2011 and June 5, 2012
 - Deposition transcript of Christopher P. Lora, dated December 21, 2011
 - Deposition transcript of Duane M. Bucossi, with exhibits and notes provided after deposition, dated June 6, 2012.
 - Deposition transcript of Travis L. Valcourt, dated June 6, 2012
 - Deposition transcript of Elizabeth A. Bundock, M.D., Ph.D., with exhibits, dated June 7, 2012
 - Deposition transcript of Christopher Loyzelle, dated June 8, 2012
 - Deposition transcript of Thomas J. O'Neil, J.R., dated October 16, 2012
 - Deposition transcript of Americo F. Monteiro, dated October 16, 2012

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- Deposition transcript of Francis T. Keefe, dated October 16, 2012
- Deposition transcript of Ruhi Arslanoglu, Ph.D., with exhibits, dated October 24, 2013
- Deposition transcript of Terrance D. Martin, with exhibits, dated November 11, 2013
- Deposition transcript of George H. Meinschein, P.E., with exhibits, dated November 18, 2013
- Deposition transcript of William L. Manion, M.D., Ph.D., dated December 12, 2013
- Autopsy Records Pertaining to Edvin Medina, including from:
 - Vermont Office of the Chief Medical Examiner
 - AIT Laboratories
 - Fletcher Allen Health Care
 - PHI Air Medical
 - Dental records
- Video of accident scene by Claude Marcoux, dated February 5, 2008
- Plaintiff Expert Reports:
 - Report and C.V. of Ruhi Arslanoglu, Ph.D., dated February 20, 2013
 - Report and C.V. of William L. Manion, M.D., Ph.D., dated February 3, 2013
 - Report and C.V. of Terrance D. Martin, dated February 22, 2013
 - Report and C.V. of George H. Meinschein, P.E., dated February 19, 2013 and supplemental report dated September 23, 2013

Accident Summary

According to the State of Vermont Uniform Crash Report, the incident occurred on February 5, 2008, at 7:26 A.M. on Interstate 91 northbound, eight feet north of mile marker 8 in Brattleboro, Vermont. At this time and location, it was dawn, with weather conditions listed as “sleet, hail (freezing rain or drizzle).”

At the time of the collision, Thomas Oneil (age 75) was driving a 2005 Dodge Caravan and Edvin Medina (age 35) was the operator of a 2003 Freightliner C21 tractor-trailer (tractor VIN 1FUJBBCG63PK58403 with trailer VIN 1L01A5324W1134462)¹. The estimated travel speed of both vehicles was 65 miles per hour. Mr. Medina was listed as not being ejected from the vehicle, with his restraint status listed as “not reported.” The airbag deployment status was listed as “unknown.” Mr. Medina sustained fatal injuries.

¹ According to DTNA’s Answers to Plaintiffs’ Notice for Production, the vehicle was a 2003 Freightliner Model CST120.

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According to Police Officer Loyzelle, “the road was wet and icy...and the portion of interstate that the crash occurred on [was] on a slight downward grade with a slight curve to the right. During the curve the interstate starts to pass over the Williams Street Bridge.” A section of the guard rail on the west side of the northbound lanes was missing, with nine guard rail posts reported as “damaged.” Upon his arrival, Officer Loyzelle reported observing the tractor-trailer on fire on Williams Street. He reported that “the tractor-trailer was fully engulfed in flames and during its descent to Williams Street took out a live power line.” The fire department did not put out the fire immediately due to safety concerns regarding the displaced power line.

According to the crash narrative, the tractor-trailer was “traveling too fast for the poor road conditions.” Officer Loyzelle reported that Mr. Medina took evasive action to avoid a collision causing the trailer on his vehicle to slide along the western guard rail. The trailer then moved across the northbound lanes of traffic and struck the eastern guard rails. Mr. Medina overcorrected, resulting in the trailer striking the western guard rail posts. During this interaction, one of the diesel tanks was punctured. The tractor-trailer then traveled through the guardrails and fell from the bridge to the embankment below. The vehicle was completely engulfed in flames for approximately 40 minutes.

According to Sergeant Stringer’s reconstruction, the vertical distance from the curbing edge of the west side of the bridge to the north side edge of Williams Street below the bridge was 61 feet. Sergeant Stringer further reported that the tractor and trailer remained attached as they fell from the bridge. The vehicle impacted the embankment with the left side of the tractor and the nose of the trailer, after which the trailer fell to the north and came to rest on its right side. The tractor, according to Sergeant Stringer, “bounced” from the left side and into the bridge support north west column of the northbound lanes. Sergeant Stringer also reported that the power line “sheared the cab portion free and it leaned against the support column between the truck tractor frame and column. This was the initial position of rest of the truck tractor as well as the semi-trailer (lying on its right side) when the fire department arrived on the scene.” After the fire department extinguished the fire the tractor fell back to the west and came to rest on its wheels.

According to Corporal Marcoux, the cab had become dislodged from its originally mounted frame and was found lying on the embankment “completely burned in close proximity to the tractor remains.” The cab remains were between the tractor and the bridge pillar. Corporal Marcoux observed the deceased body of Mr. Medina “at its final point of rest in the cab remains. It was badly burned and located between the remains of the seat and what appeared to be the sleeper birth [sic] mattress.”

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Deposition Testimony

Americo Monteiro

Mr. Monteiro was a witness to the accident and was driving a tractor-trailer on the northbound lane of I-91. He observed Mr. Medina's tractor-trailer passing him approximately 400 feet from the bridge. He stated, "And about three hundred feet in front of me he hit the bridge, the trailer got squirrely, he came across. And I didn't actually see him hit the minivan, but he came across and he slammed the right part of the bridge where the guardrail is. Then he snapped back and went back across to the left and went through the guardrail and over the embankment. He stated that the tractor left the bridge first, followed by the entire vehicle. Mr. Monteiro estimated that Mr. Medina was traveling "at least sixty [miles per hour]."

Christopher Buckley

Sergeant Buckley responded to the accident scene and was the supervisor for the Brattleboro police officers. He testified that Sergeant Stringer was the accident reconstructionist who investigated the scene. Sergeant Buckley stated that the tractor-trailer's first point of impact was between the rear end of the trailer (the ICC bar) and the guardrail on the west side of the road. The tractor-trailer then swung back to the east but did not make contact with anything on the eastern side of the road. The next impact occurred as the tractor-trailer jackknifed and interacted with the guardrail on the west side of the bridge. He further testified that "90 feet of guardrail section...was taken out" as the tractor-trailer interacted with the west side of the bridge. According to Sergeant Buckley, this part of the guardrail was responsible for rupturing the tractor-trailer's passenger side diesel fuel tank. He observed diesel fuel at the "spot where the big section of guardrail was wiped out."

Sergeant Buckley went down to the lower scene later in the day, and observed a completely burned tractor. He stated, "Initially they weren't able to put water on the fire because they were concerned about an electrical line that was energized so the fire had to burn for a while until they were able to be sure that it was safe for them to put water on the fire." In reading Corporal Stringer's report and upon speaking to him, he understood that the power line had sheared part of the cab as the truck went over the bridge. Upon looking at the police photographs, he stated that Mr. Medina's body was found in the cab of the truck, "near the bed."

Christopher Loyzelle

According to the testimony of Police Officer Christopher Loyzelle, he arrived as the first responding officer at the scene approximately fifteen minutes after the incident had occurred. Officer Loyzelle was taking photographs of the minivan/hearse when he heard "a mini explosion of tanks underneath the bridge." When Officer Loyzelle first noticed smoke from

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Williams Street he looked over the side of the bridge and saw dark, black smoke coming from the truck tractor below which was fully engulfed in flames.

Duane Bucossi

Mr. Bucossi was the fire chief of the Brattleboro fire department who responded to the accident scene. He arrived at the scene from Williams Street. Mr. Bucossi recalled that the cab was facing uphill and north on the slope off Williams Street and was fully engulfed in fire. He described the noises as “normal crackling and popping of a fire.” According to Mr. Bucossi’s testimony, the assistant chief reported that a power line was down and was located near the fallen tractor-trailer. Therefore, the fire department waited for the power company to shut down the electricity in that area prior to extinguishing the flames.

Claude Marcoux

Corporal Marcoux was a responding police officer who videotaped the accident scene and some physical evidence at the scene. When he arrived at the scene, the fire was no longer burning, and Mr. Medina’s body was still in the truck. He observed the tractor on the side bank underneath the northbound lane facing uphill and the trailer was lying on its side facing downhill “in a jackknife position except [the tractor and trailer] were disconnected.” He observed Mr. Medina’s body in the cab’s sleeper area. Corporal Marcoux also captured on the video blood and “red matter” on the piece of the fence that interacted with the tractor-trailer and fell with the vehicle to the hill below.

Albert Stringer

Sergeant Stringer was the responding police officer at the accident scene who provided accident reconstruction analysis. According to Sergeant Stringer, the roads were wet and “icing up in places” and the fire involving the tractor-trailer had stopped burning when he arrived at the accident scene. He testified that according to his reconstruction, “[the tractor-trailer] collided with the guardrails on the left side of the bridge and then it being a semi-trailer things start to maneuver independent because that’s just what happens when you have a pivot point. Then [it] ends up colliding a second time with the guardrails on the left side or west side of the highway. At that point vehicle [it] goes through the guardrails. The semi-trailer portion of it actually is described as being shot straight up in the air. [The tractor-trailer] while on top of the bridge, falls down off the highway, impacts power line which severs the cab... It then lies on the embankment portion [of] Williams Street...and continues to burn for some time because there was concern about whether that power line was still energized. And then after the fire department was certain it was not energized they put the fire out.”

Sergeant Stringer described the tractor-trailer’s final impact on the bridge, stating, “we’re talking about the truck portion initially, and then as it impacted it being slowed down being made to come from a northerly orientation to the westerly orientation. So the front initially being

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oriented kind of northerly impacting those posts and guardrails, and then as it's being slowed the momentum driving the semi-trailer forward that the front went from the north to the west." He agreed that the tractor was rotating in a counterclockwise manner, with the front and passenger side of the tractor coming into contact with the guardrails as well prior to falling from the bridge. The trailer continued in the northerly/northwesterly direction until "gravity takes over the truck tractor...the semi-trailer making a nose dive down" to the embankment below. According to Sergeant Stringer, the tractor fell first, followed by the trailer. According to witnesses, the vehicle was on fire as it was falling. He observed a debris field of batteries, pieces of guardrail and cowling at the impact point and continuing in a northeasterly direction. During the interaction with the guardrails, a portion of the guardrails became lodged in the undercarriage of the vehicle.

When he observed the tractor-trailer in its rest position, he noted that the vehicle had fallen back on its wheels and he noted that the frame rails were bent. He also observed guardrail support and mesh screen from the bridge had come through the truck tractor. The mattress of the sleeper "fell off the truck" and was lying "on the side...on the ground." He believed that the tractor-trailer landed on its right side and the tractor "flipped onto its wheels at some point."

Sergeant Stringer estimated that the maximal fall of the vehicle was "probably 50 feet" from the bridge to its first impact point on the embankment. He testified, "Well, I believe as [the tractor] left the highway it was like this, it started to fall, then it got tangled with the power lines which then made it come back to its opposite side and then made it come down like that leaning up against the post and then it eventually came free from there and fell back onto its wheels." He believed that the power line went through the cab of the tractor "where the driver sits" and entered the passenger compartment.

Elizabeth Bundock

Dr. Bundock was the medical examiner of the state of Vermont and performed the autopsy on the body of Edvin Medina. Regarding head trauma, Dr. Bundock testified that Mr. Medina's brain had "a substantial amount of fire artifact." She further stated, "the outer table of the skull...fractured off, and the inner table did not. So there was an area where the outer table fractured off, and the inner table remained intact... I was trying to describe why I thought the edges seemed to be more consistent with post-mortem fire artifact versus anything I could identify as being certainly traumatic." Dr. Bundock agreed that pre-mortem (or antemortem) blunt trauma injuries to the head and brain could not be ruled out.

According to Dr. Bundock's testimony, the hemothorax listed in the autopsy report was primarily due to rib fractures and left lung laceration; pleura lacerations would have been located around the rib fractures as well. She did not believe that the documented rib fractures resulted in flail chest. With regard to the volume of the documented hemoperitoneum, she stated, "it could be 100 mls. It could be 200 mls. You know, maybe it's 5- or 600 mls."

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Dr. Bundock also testified that while the right femoral fracture had characteristics suggestive of fire fracture, the left femoral fracture was “suggestive of antemortem blunt trauma” and was more difficult to differentiate and was therefore of indeterminate cause with regard to fire or blunt trauma. She testified that in the autopsy report, she described the fractures due to fire as “transverse and linear...straight line type fractures” and described blunt trauma fractures as more jagged with longer lines of fracture.

Dr. Bundock testified that the pugilistic posturing indicated in the autopsy report was not reflective of Mr. Medina’s position, but rather, was a post-mortem change. She also believed that Mr. Medina would likely have died from the blunt trauma his body received in the accident. Dr. Bundock testified that nothing in her autopsy findings could tell her whether or not Mr. Medina was wearing his seatbelt at the time of the accident.

Regarding smoke inhalation, Dr. Bundock testified that the AIT laboratory results of Mr. Medina’s sample reported “negative” for carbon monoxide content, while the Fletcher Allen laboratory found 10.9% carboxyhemoglobin. In her experience, the carboxyhemoglobin level in smokers ranged from 5 to 10%, and she thought that the 10.9% level found for Mr. Medina was “only marginally above” that of smokers. Dr. Bundock testified that if a person were alive during the fire and his/her carboxyhemoglobin level was low or negative, the fire could be a “flash fire or a very intense hydrocarbon fuel fire, and the reason you might have that circumstance is that the fire is extremely intense in its heat, and it is causing the death of the person through using up all the oxygen in the air, super-heating the body.” She also found Mr. Medina’s lungs to be anthracotic, which she stated “refers to carbon pigment in the lungs. Most often that is from tobacco smoking or environmental carbon sources. Typically a fire victim that is alive during the fire and dies briefly thereafter, the carbon pigment from the soot of the fire or the smoke of the fire isn’t distributed throughout the entire lung tissue. It’s mostly in the deep airways and perhaps the alveoli around, you know, some of the central airways. But it has a slightly different appearance than what we see from smoking tobacco or being in a work or environmental situation where there’s a lot of smoke during life, you know, over the course of years.” She did not include smoke inhalation as the cause of death because she did “not have the elevated carboxyhemoglobin to suggest it was a major mechanism in the death. So there is smoke inhalation present and described, but was not likely a major contributor to the death mechanism.” Dr. Bundock testified that she believed Mr. Medina was alive at the time of the fire, and in her opinion, “the approximate interval between the onset of the trauma and the death was minute to minutes.” She stated that the smoke inhalation did not indicate whether or not the person was conscious at time.

Autopsy Findings for Edvin Medina

According to the final report of autopsy by Elizabeth Bundock, M.D., Ph.D., Deputy Chief Medical Examiner, dated February 26, 2008, Mr. Medina was pronounced dead at the accident

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scene at 9:37 A.M. on February 5, 2008. The Vermont Certificate of Death listed the cause of death as blunt trauma of the torso and thermal injuries.

According to laboratory results from the American Institute of Toxicology, dated February 19, 2008, Mr. Medina's cardiac blood tested negative for carbon monoxide content. According to results from the Fletcher Allen Healthcare Outpatient Laboratory Report, dated February 6, 2008, Mr. Medina's carboxyhemoglobin level was 10.9%.

Mr. Medina's autopsy report noted the following injuries:

- Charring of skin and exposed tissue (100% body surface area); body is "charred, rigid, and pugilistic"
 - Charred skeletal muscle and bone are exposed over approximately 90% of the body, with the only remaining areas of leathery skin being on the chest and abdomen
- Head and neck
 - Calvarium is entirely absent
 - Broken edges of the skull are irregular and jagged with fractures of the outer table that reveal trabecular bone
 - Exposed dura is lacerated
 - Artifactual epidural hemorrhage
 - Fragmented brain is firm, dehydrated and focally burned
- Torso
 - Soot in larynx, trachea and distal bronchi
 - Large laceration of the right lateral abdominal wall (tearing perpendicular to muscle fibers) with partial evisceration of the intestines
 - Rib fractures surrounded by hemorrhage and associated with lacerations of the parietal pleura
 - Posterior fractures of right ribs 2-10
 - Anterior fractures of right ribs 8-9
 - Contusions of the right lung and hilar laceration of the left lung
 - Extensive liver lacerations and several hundred milliliters of hemoperitoneum
 - Hemothorax (approximately 300 to 400 milliliters in each pleural cavity)
- Upper extremities
 - Dislocations at the elbows and wrists
 - Hands "reduced to balls of carpal...bones"
 - Irregular, blocky, artifactual fractures of dehydrated and charred right radius and ulna
 - Distal fractures of the left ulna (oblique) and radius (transverse) at the same level; bones are exposed and charred, but the fracture edges are smooth
- Lower extremities

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- Dislocations at knees and ankles
- Feet “reduced to balls of ...tarsal bones”
- Bilateral knees flexed by muscle shrinkage
- Irregular, blocky, artifactual fractures of dehydrated and charred right tibia and fibula
- Distal femoral fractures in areas of full bone exposure and charring
 - Right femoral fracture is irregular and blocky
 - Left femoral fracture has both smooth and irregular areas

Biomechanical Analysis

The tractor-trailer crash of February 8, 2008, was evaluated from a biomechanical engineering perspective to assess the occupant kinematics of Edvin Medina during the crash, to determine the mechanisms of his injuries, and to evaluate biomechanical issues associated with the information and opinions provided by plaintiff’s experts. These evaluations were based on the materials reviewed (listed at the beginning of this report), the laws of physics; principles of occupant kinematics; literature pertaining to injury biomechanics, including automotive biomechanics; published biomechanical data (involving volunteers, instrumented dummies, and cadavers); and the knowledge, education, and experience of the author. The evaluation also involved a detailed review of Mr. Medina’s autopsy records, including examination of the autopsy photographs and of the deposition testimony of medical examiner Elizabeth Bundock, M.D., Ph.D. I have also relied upon the accident reconstruction of Kevan Granat.

According to the police investigation of the subject accident, the Freightliner truck driven by Mr. Medina was traveling northbound on Interstate 91 through conditions described by police as “wet, icy, snow, slush.” While reportedly taking evasive action to avoid a collision with another vehicle, Mr. Medina’s truck lost control, jackknifed, and went through the guardrail on the west side of the northbound bridge, falling to the embankment below. Based on Mr. Granat’s accident reconstruction analysis, the Freightliner tractor yawed counterclockwise while traveling on the bridge, jackknifing to the left, and engaged the west side bridge rail in a passenger’s-side-leading orientation. As the tractor continued through the bridge rail posts, it continued to yaw, so that the lateral impact to the right side of the tractor chassis from each consecutive post took on an increasingly rearward force component. The tractor-trailer proceeded over the edge of the elevated bridge, still jackknifed to the left and continuing to yaw as it fell approximately 32 feet to impact the embankment below. As the tractor-trailer fell, some portion of the vehicle caught on the high voltage power lines. Impacting the embankment, the trailer presented its bottom side (wheels) and right side to the ground, while the tractor was pitched nose-up, and struck the ground tail-end leading. When the tractor struck the ground in this orientation, the fall of the chassis was abruptly arrested, but the cab continued toward the ground due to its inertia, displacing it rightward and rearward relative to the upended chassis. Tearing free from the chassis as a result of the ground impact, the cab landed on the ground to

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the right side of the chassis, aft of its original mounting location, and rotated approximately one-quarter turn counterclockwise relative to the chassis. At some point during the course of the crash, a fire started in the vehicle, causing thermal damage to chassis structures and to the separated cab of the tractor.

When a vehicle collides with another object, the momentum transfer results in a change in velocity of the vehicle, referred to in engineering terms as the delta-V. This change in velocity occurs over a relatively small period of time, usually a fraction of a second depending upon the nature of the impact. As the jackknifed tractor-trailer passed through the bridge rail and through a series of bridge rail posts with its right side leading, it experienced a series of small delta-V impacts initially from the right and later from the right rear. Subsequently, the tractor-trailer traveled over the edge of the bridge and fell approximately 32 feet to the embankment below, a distance corresponding to a ground impact speed over 30 miles per hour due to gravitational acceleration. Thus, the truck impacted the ground and stopped with a delta-V of approximately 30 miles per hour.

As collision forces change the velocity of a vehicle, the occupants initially continue to travel at their pre-collision velocity. This discrepancy between the velocity of the vehicle and the velocity of the occupants produces movement of the occupants relative to the vehicle interior. This movement continues until it is arrested via interaction with the restraints system and/or interior structures. As the subject Freightliner tractor impacted a series of bridge rail posts, Mr. Medina initially moved to his right, toward the area between the front seats. As the tractor continued to yaw counterclockwise, Mr. Medina's inboard movement as a result of post impacts took on an increasingly rearward component, tending to move him inboard and rearward between the front seats toward the sleeper area of the cab. When the upended and falling tractor impacted the ground tail-end leading, Mr. Medina's body continued toward the ground, which was toward the right rear interior walls of the sleeper area of the cab. The restraint system was consumed in the subsequent fire, leaving no physical evidence by which to evaluate whether Mr. Medina was using his seat belt. However, as will be discussed below, blunt trauma injuries to his torso are consistent with unrestrained inboard motion and subsequent projection into the sleeper area of the cab upon ground impact.

The autopsy report by Deputy Chief Medical Examiner Elizabeth Bundock, M.D., Ph.D., recorded several serious blunt trauma injuries to Mr. Medina's torso and extremities. Blunt trauma injuries to his chest included: numerous right rib fractures, specifically the right 2nd through 10th ribs posteriorly and the right 8th and 9th ribs anteriorly, with associated parietal pleural lacerations and surrounding pleural hemorrhage; right lung contusions; a left pulmonary hilar laceration; and bilateral lung hemothorax (300 to 400 milliliters of blood each side). To his abdomen, Mr. Medina had extensive liver lacerations with hemoperitoneum (several hundred milliliters). This blunt trauma to Mr. Medina's torso, particular to the right posterior ribcage, was the result of his striking structures behind him in the sleeper area of the cab –such as the cabinets, the bunk and/or the exterior walls of the sleeper– when the truck struck the ground.

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Mr. Medina also had an oblique fracture of the left ulna and a transverse fracture of the left radius at the same level, which Dr. Bundock concluded to be the result of blunt trauma based on fracture characteristics, and a left femur fracture that Dr. Bundock noted to have characteristics “suggestive of antemortem blunt trauma.” The precise source of these extremity injuries is uncertain, but the requisite energy and force for such orthopedic trauma is consistent with forceful contact with structures in the sleeper area of the cab upon ground contact, similar to the source of Mr. Medina’s torso injuries.

Mr. Medina also had a large laceration of his right abdominal wall with partial evisceration of the intestines. This injury was caused by a section of woven mesh fence and a steel fence post, which penetrated the cab of the tractor and Mr. Medina’s body during the truck’s fall from the bridge. Vermont State Police photographs of the scene and video footage recorded by Police Corporal Claude Marcoux show bloody, uncharred tissue on a section of woven mesh fence and a section of steel pipe, which served as a fence post. This section of fence and post were located, at rest, between the left side of the tractor chassis and the bottom side of the trailer. The fence was originally affixed outside the bridge rails on the west side of the northbound I-91 bridge, until the tractor-trailer evidently became entangled in it during its fall to the embankment below, pulling the fence down with it. The presence of this “blood and matter on fence,” as identified by Cpl. Marcoux, which was clearly not charred like the rest of Mr. Medina’s body and was located remote from the cab, indicates that the fence penetrated both the cab and Mr. Medina’s body at some point during the fall from the bridge, but separated from his body and cab prior to final rest on the embankment. Although several charred “open” wounds were caused post-mortem by the fire, the only open wound to Mr. Medina’s body clearly identifiable as pre-mortem is the large abdominal tear and intestinal evisceration, associating this penetrating injury most closely with the tissue Corporal Marcoux identified on the fence.

Because Mr. Medina’s body was badly burned post-mortem, additional blunt force injuries to his body were likely obscured by thermal injuries and therefore not observed. The entire calvarium, or top of the skull, for example, was absent at the time of Dr. Bundock’s autopsy, because it had been consumed by fire. As Dr. Bundock testified, there could have been pre-mortem blunt force skull fractures and pre-mortem blunt force brain injury, which could not be ruled out given the biological evidence remaining after the fire. Given the occupant kinematics Mr. Medina experienced when the tractor and then the cab struck the ground after falling from the elevated bridge, and given the high-energy blunt trauma to the remains of Mr. Medina’s torso and extremities, it is reasonable to expect Mr. Medina’s head experienced similarly severe blunt trauma on ground impact, but that evidence of these injuries was obscured or destroyed by subsequent thermal damage.

In his report dated February 20, 2013, Ruhi Arslanoglu, Ph.D., opined that “[Mr.] Medina survived the crash and perished in the fire.” This conclusion, as Dr. Arslanoglu testified in his deposition on October 24, 2013, was based in an Abbreviated Injury Scale (AIS) analysis he performed regarding Mr. Medina’s blunt force and thermal injuries. The AIS is an injury

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scoring system developed by the American Medical Association (AMA), the Association for the Advancement of Automotive Medicine (AAAM) and the Society of Automotive Engineers (SAE), originally to quantify the type and severity of injury experienced by occupants in motor vehicle accidents, but subsequently used for other types of trauma as well. AIS scores range from AIS 1 (minor injury) to AIS 6 (maximal injury, currently untreatable). Assessing Mr. Medina's head injury separately, Dr. Arslanoglu assigned a score of AIS 0 for blunt trauma and AIS 6 for thermal injury. Other injuries to the torso and extremities he scored as AIS 2 (moderate injury) and AIS 3 (serious injury), and concluded that Mr. Medina "was not fatally injured as the result of the impacts." He also opined that "the only injury with an AIS score of 6 is the thermal injuries," and thus concluded that "[Mr.] Medina died as the result of the fire."

Dr. Arslanoglu's AIS analysis is troubled by several errors. First, it appears that Dr. Arslanoglu scored the thermal injuries of Mr. Medina's head as AIS 6 because he considered them fatal. The thermal damage to Mr. Medina's skull and brain could certainly be fatal if it occurred prior to death. However, crematory studies have demonstrated that even at temperatures exceeding 1000° Fahrenheit it takes 30 to 45 minutes for the calvarium to disintegrate. Thus, the absence of Mr. Medina's entire calvarium and thermal injury to his brain tissue are classified more accurately as thermal damage to the body after death ("post-mortem changes," as Dr. Bundock described them), rather than death-causing or fatal injury. More importantly, the AIS manual admonishes against arbitrarily assigning an AIS 6 score simply because an injury resulted in fatality, or, conversely, against identifying a fatal injury by an AIS 6 score. As the AIS manual points out, not all AIS 6 injuries result in fatality. Conversely, fatality can arise from an injury with an AIS score less than AIS 6, or from a combination of multiple injuries with scores less than AIS 6. In his deposition, Dr. Arslanoglu described his role in the investigation as determining whether the injuries were, "based on the Abbreviated Injury Scale, classified as fatal injuries." As explained above, there is no such classification as "fatal injury" in the AIS.

In his report, Dr. Arslanoglu called out explicitly that "the only injury with [an] AIS score of 6 is the thermal injury," implying that the thermal injury must therefore be the cause of Mr. Medina's fatality. This implication is wrong for two reasons. First, injuries with AIS scores less than 6 can also be fatal. Referred to the AIS coding manual during his deposition, Dr. Arslanoglu conceded that an AIS 3, AIS 4, or AIS 5 injury could be fatal. Second, if the question at hand is whether an injury contributed to fatality, or was a person's "fatal injury," that injury would necessarily have to be pre-mortem. (Injuries that occur to a dead body post-mortem cannot contribute to fatality after the fact.) However, it is not clear to what extent (or to what level of AIS severity) Mr. Medina's thermal injuries occurred pre-mortem versus post-mortem. Again, in his deposition, Dr. Arslanoglu conceded that some of the thermal injuries to Mr. Medina's body were post-mortem changes, as classified by Dr. Bundock, to whom he was deferring on whether an injury occurred pre- or post-mortem.

To assess the combined severity of multiple injuries, the AIS system provides hybrid metrics such as the Injury Severity Score (ISS). In the subject case Medina's ISS score would have been

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27 based only on his identifiable blunt trauma (as identified by Dr. Bundock). This represents a significant fatality risk. If Mr. Medina had serious, severe or critical head injuries and/or more severe thoracic or abdominal trauma that were obscured by post-mortem thermal injuries his ISS could have been much higher, representing increasingly likely fatality. While such head injuries are unknown due to post-mortem thermal damage of the skull and brain, they would be consistent with the occupant kinematics of the fall and ground impact and similarly consistent with high-energy trauma to his torso and extremities.

In his report, Dr. Arslanoglu did not address Mr. Medina's occupant kinematics or the mechanisms of his blunt force trauma. During his deposition he volunteered his ideas regarding occupant kinematics and injury mechanisms, but added that his role in this case was not to investigate how the injuries took place and that he had not independently investigated how Mr. Medina's body moved inside the truck. Dr. Arslanoglu also had no opinion on whether the cab of the truck had moved differently from the chassis; he stated, "that would be the role of [the] reconstructionist to determine if the cab is sufficiently attached to the chassis of the truck, and what happens to it is not something that I would be able to comment on." He confirmed that to the best of his knowledge no expert for the plaintiff had reconstructed the accident. Dr. Arslanoglu stated that, not having been provided with an accident reconstruction, he took information on how the truck landed from a statement in the police report that the truck impacted the embankment with the left side of the tractor and the nose of the semi-trailer. This, he stated, caused Mr. Medina to move forward and to his left. As described above, the physical evidence and Mr. Granat's reconstruction show that the tractor initially struck the embankment tail-end first, causing the cab to separate from the chassis. Although the chassis subsequently fell toward its left side and onto the embankment as noted by police, the most significant impact for Mr. Medina's kinematics occurred when the chassis initially struck the ground tail-end first and the cab separated from the chassis to the right and rearward. As described above, based on this orientation of the chassis and the cab on ground strike, Mr. Medina was propelled rearward and rightward into the sleeper area of the truck, where his body was found.

The occupant kinematics described by Dr. Arslanoglu are not only inconsistent with the vehicle kinematics in Mr. Granat's reconstruction and the physical evidence of where trailer, tractor chassis and cab came to rest on the ground, but also inconsistent with the blunt trauma to Mr. Medina's torso, particularly to his ribcage. Dr. Arslanoglu stated that Mr. Medina's rib fractures, which were all on the right side and primarily posterior (ribs 2-10), were the result of interacting with the shoulder harness of his seat belt as he moved forward and leftward. The shoulder harness of a driver's belt, however, passes over the anterior torso from the left shoulder to the right iliac crest. While a small part of the driver's shoulder harness might have crossed over the lower right ribcage, interaction with the shoulder harness would not account for the majority of posterior rib fractures on the right side of Mr. Medina's torso. Again, as described above Mr. Medina moved rightward and rearward on ground impact and received his posterior right rib fractures striking structures in the sleeper area of the cab. It was also these kinematics

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upon ground impact that resulted in Mr. Medina's final location in the sleeper area of the cab behind the front seats, not Mr. Medina moving around inside the cab after the collision, as Dr. Arslanoglu suggested.

In a report dated February 3, 2013, William L. Manion, M.D., Ph.D., concluded that "Mr. Medina died as the direct consequence of the fire, not blunt force injuries," and cited that witnesses were reported to have heard screaming after the crash. Dr. Manion's report made no indication of any assessment of Mr. Medina's specific blunt force injuries. In his deposition of December 12, 2013, Dr. Manion agreed that it was possible in general that calvarium fracture could occur or that trauma to the top of the head could render someone unconscious, and that evidence of such trauma could be destroyed if the calvarium was not present afterward due to fire. However, he testified, that had not occurred in this situation because, "If the skull fracture was that severe, you wouldn't have heard him screaming on the ground." Asked if his opinion that Mr. Medina had no calvarium fracture was based solely on witness statements regarding screaming, he noted the absence of basilar skull fractures reported by Dr. Bundock, indicating that a basilar skull fracture would be evidence of violent or very severe head trauma that "could make you unconscious." It is important to note that while head impacts severe enough to fracture the calvarium and cause significant head injury can produce fracture lines extending into the basilar skull, or sometimes even produce independent basilar skull fractures, this is frequently not the case. Numerous cadaveric head impact studies have reported serious calvarial fractures and intracranial trauma without any associated fracture of the basilar skull. It is also noteworthy that head impact forces resulting in loss of consciousness are frequently much less than the impact force necessary to fracture the calvarium or the basilar skull. In sum, the absence of a basilar skull fracture is not a good indicator of absence of a calvarial fracture and it is also not a good indicator that loss of consciousness did not occur.

Conclusions

The opinions in this report are based upon my analysis of the subject accident, the materials reviewed and my education, experience, and knowledge:

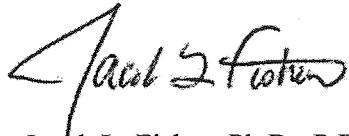
1. In the subject crash, Mr. Medina sustained serious blunt force trauma to his torso and his extremities when his tractor-trailer fell from an elevated bridge and struck an embankment more than 30 feet below. Due to the tractor striking the ground tail-end leading, Mr. Medina's body was projected rearward into the sleeper portion of his cab where he impacted structures in the sleeper that resulted in his torso and extremity trauma.
2. Post-mortem damage to Mr. Medina's body as a result of the fire obscured or destroyed potential evidence of other blunt trauma injuries Mr. Medina may have had, especially to his head. Particularly, the calvarium was completely consumed in the fire, destroying

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evidence of potential calvarial fractures and other possible head trauma. However, based on Mr. Medina's kinematics in the crash and the severity of his blunt force torso and extremity injuries, some degree of head trauma would be expected.

These opinions are offered to a reasonable degree of biomechanical engineering and scientific certainty. If additional information becomes available, this report may be supplemented or altered.

Sincerely,



Jacob L. Fisher, Ph.D., P.E.
Managing Engineer

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**Jacob L. Fisher, Ph.D., P.E.
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Professional Profile

Dr. Jacob L. Fisher is a Managing Engineer in Exponent's Biomechanics practice. Dr. Fisher addresses issues related to human injury biomechanics. He performs biomechanical accident reconstruction based on injury mechanisms to reconstruct the physical environment in which injury occurs and to illuminate critical timing issues regarding when and the order in which injuries occur during an accident sequence. His expertise includes injury causation and mechanisms of traumatic injuries associated with vehicular, pedestrian, occupational, and recreational accidents as well as consumer products, including analysis of alternative design proposals. His work has ranged from reconstructing high-speed pedestrian accidents to analyzing scenarios leading to falls from heights. He has investigated a wide array of motor vehicle accidents and injury and timing issues related to performance of vehicular components like air bags, seat backs, and belt restraints. Dr. Fisher also analyzes injury causation matters to assess whether the mechanisms of traumatic injury are present in an event and sufficient to be related to particular pathologies. This may include analysis of alternative injury scenarios.

Dr. Fisher's current research interests include pedestrian injury analysis and accident reconstruction, pedestrian safety and protection, occupant kinematics in low- and high-speed motor vehicle collisions, effectiveness of occupant protection systems such as seat belts and air bags, and the influences of pre-existing pathologies and occupant body size on injury mechanics. He is also knowledgeable in the areas of statics and dynamics, strength of engineering materials, mathematical modeling of biological systems, numerical methods and statistics.

Prior to joining Exponent, Dr. Fisher was a Whitaker Foundation Research Fellow in the Injury Biomechanics Laboratory at the University of Pennsylvania, where he investigated the biomechanics of ventilator-induced lung injury in alveolar epithelial cells, including the effects of mechanical strain on ionic transport, mechanotransduction leading to ionic channel modulation, and cellular membrane mechanics associated with these phenomena. Dr. Fisher continues to serve as a visiting lecturer at the University of Pennsylvania. Dr. Fisher was also an intern at the Institute for Aerospace Medicine at the German Aerospace Center in Cologne, Germany, where he analyzed biofilm sensitivity for aerospace applications. His undergraduate honors research at Penn State University analyzed backflow patterns around tilting disc heart valves.

Academic Credentials and Professional Honors

Ph.D., Bioengineering, University of Pennsylvania, Philadelphia, 2003
B.S., Engineering Science and Mechanics, Penn State University (*summa cum laude*), 1996
Minors in Bioengineering and German, Penn State University

Whitaker Foundation Graduate Student Fellowship in Biomedical Engineering
National Science Foundation Graduate Research Fellowship
Ashton Fellowship, University of Pennsylvania
Student Marshall of Engineering Science and Mechanics (top of class), Penn State University
Robert L. Waltmeyer Scholarship, Penn State University
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Licenses and Certifications

Licensed Professional Engineer, Maryland, #36778

Languages

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Publications

Heller MF, Prange MT, Ong KL, Watson HN, Iyer M, Ivarsson BJ, Fisher JL. Injury patterns among special populations involved in pedestrian crashes. Society of Automotive Engineers (SAE) Technical Paper 2010-01-1165, 2010.

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Selected Invited Presentations

Fisher JL. Applications of biomechanics to real world accidents. Graduate Student Seminar, Massachusetts Institute of Technology, Cambridge, MA, May 19, 2010.

Fisher JL. Applications of injury biomechanics. Nursing 334/534: Forensic Science, University of Pennsylvania, Philadelphia, PA, February 22, 2010.

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Fisher JL. Injury biomechanics: determination of injury mechanisms in real-world accidents. Nursing 334/534: Forensic Science, University of Pennsylvania, Philadelphia, PA, March 13, 2006.

Fisher JL. Applications of injury biomechanics. Nursing 534: Forensic Science, University of Pennsylvania, Philadelphia, PA, March 21, 2005.

Project Experience

Reconstructed numerous accidents involving injured pedestrians and other extra-vehicular persons (e.g., occupants who had exited a vehicle), based on physical vehicle evidence, human kinematics, and injury patterns and mechanisms.

Analyzed occupant kinematics and injury mechanisms in frontal, rear-end, side impact, and rollover automotive collisions, including analysis of high speed rear-end collisions with regard to seat back yielding and lateral impacts with regard to side air bag presence and/or deployment.

Performed accident site investigations and biomechanical analyses of automotive pedestrian accidents, and slip-and-fall / trip-and-fall premises liability cases (on- and offshore).

Designed and conducted automotive sled testing with ATDs (crash test dummies) and roll-spit testing with human surrogates in the context of biomechanical analyses of real-world crashes.

Analyzed occupant kinematics and injury mechanisms in automotive accidents involving improper use of vehicle restraints, including improper seat belt routing (e.g., lap belt under the legs, shoulder harness behind the back, or under both arms) and situations with unusual belt geometry as a result of out-of-position seating. Analyses included a differential evaluation of injury potential in misuse scenarios versus proper use.

Investigated injuries sustained in sporting activities, such as personal watercraft accidents and horseback riding.

Performed numerous analyses of low-energy automotive accidents, including sideswipes and low-speed rear-end and frontal collisions to evaluate potential injury causation, exacerbation, or mitigation. Such analyses include comparisons of motions and forces experienced in an incident with those experienced in activities of daily living.

Evaluated the effects of congenital or degenerative pathologies, such as Klippel-Feil syndrome, ankylosing spondylitis, and diffuse idiopathic skeletal hyperostosis (DISH) on potential injury mechanisms and injury tolerance.